The Growth in Access to Local Produce within Urban Populations in Southeastern Wisconsin

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Abstract

The growth in access to local food in urban areas is an important topic concerning a large population of people. A source used to connect people with fresh food is the Farm Fresh Atlas which provides a listing of local farms and markets to buy produce from. Using, ArcGIS, maps were used to examine whether there is a difference in access to farms, farmers’ markets and community supported agriculture (CSA) locations from 2008 to 2014 in urban areas in Southeastern Wisconsin. Statistics were used including a t-test to determine the significance in access through averages for travel drive time. A key finding was that the average drive time for farmers’ markets and CSA’s significantly decreased while travel drive time to farms increased between 2008 and 2014.
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Introduction

Access to local food has been a growing concern within the last decade. More people are participating in CSA’s (Community Supported Agriculture) by buying produce directly from a farm along with making special trips to local farmers’ markets to get fresh food. With the increase in availability of urban agriculture, fresh produce is more accessible. Urban agriculture is the practice of cultivating and distributing food in a city. Food uncertainty is seen all over the world, while the United States is facing a growing problem of obesity. With unhealthy options at a cheap price, it is important to explore a healthy and accessible way for urban areas to find better nutritious options. More individuals are interested in knowing where their food comes from along with how far food typically travels to get to their plates. Urban agriculture including small farms, CSA’s and farmers’ markets can help bridge the gap between people and accessible fresh food.

While agriculture in urban areas is not a new idea, its popularity is increasing. In 1996, 30% of agricultural production originated in metropolitan areas within the United States (United States Department of Agriculture 2012). Farmers’ markets have significantly increased 1994-2006 from around seventeen hundred markets to near forty-five hundred operating markets in the United States (Zepeda 2009). With an increase in agriculture, there also is an increase in energy used from shipping food long distances to consumers. Urban agriculture and farmers’ markets look to address this problem by providing a more sustainable food system closer to home where organic methods are used to reduce the distance between food production and human consumption. Given the rise of access to local produce through farmers’ markets, community supported agriculture and direct purchasing from small farms, urban populations have better
opportunities to travel a shorter distance to buy locally grown produce from 2008 to 2014 in Southeastern Wisconsin.
Literature Review

There is a growing interest in local food throughout the United States. The definition of “local” by the U.S. Congress in the 2008 Food, Conservation, and Energy Act (Farm Bill 2008) states the term “locally or regionally produced agricultural food product” is less than 400 miles from its origin, or within the State in which it is produced (Waltz 2010). At 60 mph, to travel 400 miles would take over 6 hours to reach the destination. With the use of urban agriculture, more local food can be grown using sustainable practices.

Organic agriculture has been an increasingly used method to produce locally grown food that is sustainable for the environment. Organic food sales have grown in the United States by 20% in the last ten years especially in urban and suburban areas (Mariola 2003). This growth continues through farmers’ markets, community supported agriculture and small farms as well as in many supermarkets nationwide. Wisconsin farmers are leaders in organic food production, especially in dairy. The word ‘organic’ was used in 1997 by Lord Northbourne in the book “Look to the Land” to mean ‘the farm itself must have a biological completeness; it must be a living entity, it must be a unit which has within itself a balanced organic life’ (Northbourne 2004). The USDA defines organic agriculture as an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on the minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony (Organic Food Production Act 1990). These definitions outline principles of organic agriculture including sustain and enhance the health of the soil and humans, work with ecological cycles, provide a good quality of life to humans, and use a precautionary approach regarding the well-being of humans and the environment. While “organic” is a term associated with certified organic produce; certain requirements need to be met. For instance,
organic farms and producers need to preserve natural resources and biodiversity, provide outdoor access to animals, adhere to routine inspections, separate organic from non-organic food and avoid using genetically modified food. Organic products are typically higher in price, growing the $35 billion U.S. market for organic produce (USDA 2012). Overall, most operations need to be certified organic in order to sell organic products.

While conventional farming methods use fertilizers, pesticides and insecticides that harm the environment and human health; organic agriculture techniques avoids these chemicals and uses natural means such as manure to grow organic food. The Organic Trade Association is a non-profit organization that promotes organic trade to better the environment, the farmer, the public and the economy. This local growth impacts a variety of people and helps sustain the environment to grow future produce. Rapid growth of organic farming and food production, especially in Europe and in the United States has taken place since 2005 (Givens 2008). Organic agriculture protects the long-term fertility of the soils by making it more sustainable in the future. Also, by routinely practicing crop rotation on farms, ecological benefits are produced while limiting disease, weeds and improving a balance between nutrients for crops. By paying attention to the impact of farming on an ecosystem; it allows for an understanding of the soil structure and other environmental influences that affect the way food is grown. Knowing where food comes from and buying locally will help the local community, farmers and the economy.
Previous Research

Public interest in buying local food has been a topic previously acknowledged to understand why the number of farmers’ markets grew while wholesale supply systems extended in the past 30 years. A historical study titled Counting Farmers Markets by Allison Brown provided a representation on the growth of farmers’ markets and how this has come to be with population increase and urbanization between 1800 and 2000.

An increase in agricultural production with rapid technology improvements caused a decrease in the number of farmers’ markets around the United States until the Farmer-to-Consumer Direct Marketing Act of 1976. This act gave various supplements that allowed farmers and local people to organize markets which sparked consumer demand for fresh food. In 1946, there were 724 markets of all classes in the United States (Brown 2002). Then in 2000, farmers’ markets grew to just under 3,000 nationwide.

The explanation for the cause of an increase in farmers’ markets includes a demand for food in an increasingly urbanized population. Before improved transportation, fresh produce was produced locally and available on a seasonal basis. In the United States, farmers’ markets are rich and complex that involve millions of people which generated a comeback in farmers’ markets and farmer-to-consumer direct purchasing.
Figure 1: Farmers’ Markets in the United States, 1800–2000. Graph showing the rise in the number of farmers’ markets from 1800–2000.

A research article by Lydia Zepeda titled “Which little piggy goes to market? Characteristics of U.S. farmers’ market shoppers”, describes the growth in markets and how they appeal to a broader population. This study looks at the different characteristics of why some shop at farmers’ markets and why others do not. While farmers’ markets benefit not only the consumers and producers, they also support the community. Factors influencing the likelihood of attending farmers’ markets include education. Other factors included: nutrition, freshness, and concerns about the environment. Surveys were mailed to over 900 U.S. citizens to help examine characteristics that motivated people to attend farmers’ markets. Information gathered from the surveys indicated that almost eighty percent out of population sampled receive access to farmers’ markets and direct purchase from farms. Buying organic food occasionally increased the probability of shopping at a farmers’ market by eighteen percent. While this study, shows positive support for farmers’ markets and organic food; people who participate in this lifestyle more often than not responded to the survey possibly skewing the results. Overall, probability of
going to a farmers’ market was significant by the following: enjoyment of cooking and being female whereas income did not significantly influence shoppers from attending (Zepeda 2009).

A study done investigating urban agriculture in Milwaukee looked at organizations that encouraged the growth of growing and buying local produce. With a growing demand for country of origin on labeling fruits, vegetables, and meats, there is an increase in awareness of how food is being produced. Urban agriculture boosts the communities in access to food and better nutrition with urban farms and markets. The result of producing local food has increased the number of farmers’ markets in the United States from 1,755 in 1994 to 4,685 in 2008 making a 166% increase (USDA 2012). The City of Milwaukee has a diverse number of organizations promoting urban agriculture including Growing Power. Growing Power is a non-profit organization that serves as a farm. This organization practices sustainable agriculture on two-acre land including multiple greenhouses where members can buy weekly baskets of food. Overall, Milwaukee is a great example of the growth of sustainable agriculture where urban populations have access to fresh local produce.

**Small farms**

Wisconsin is the third in the nation for the number of certified organic farms and is just behind that of California and Washington. Wisconsin farms cover 91,000 acres, equaling 4% of the total organic farming area in the nation (Mariola 2003). Small farms rely on the public for support and to buy produce in order to maintain their farm. By going to small farms, people know exactly how their food is grown and what is used to grow their food. Local food markets typically involve small farmers, and according to the 2007 U.S. Census of Agriculture, most farms that sold directly to consumers are small farms with less than $50,000 in total farm sales
(U.S. Census of Agriculture 2007). Some consumers who value high-quality foods produced with low environmental impact are willing to pay more for locally produced food (Waltz 2010). Communities gain knowledge of the quality of food through direct contact with the farmer. In terms of distance people travel to reach small farms depends on the region and how dense the population is. Motives for “buying local” include quality of freshness and support for the local economy. Overall, consumers who are willing to pay higher prices for locally produced foods place an emphasis on product quality, nutritional value, methods of growing a product and impacts on the environment along with support for local farmers.

**Farmers’ Markets**

In the United States, farmers’ markets rose from 2,756 in 1998 to 5,274 in 2009 (Waltz 2010). Many Wisconsin farmers rely on direct marketing to sell their produce. Wisconsin also is a national leader in the number of farmers’ markets; consisting of over 150 markets within the state (Mariola 2003). While many people go to supermarkets, most of that food travels many miles before it is sold to consumers. Not only are farmers’ markets local, the produce is fresh and there are many health benefits to eating fresh food. Only 3% of food was sold at farmers’ markets in 2009; however, organic food has grown and more people continue to become interested in organic produce (MacLachlan 2012). Today, grocery stores are advertising “organic produce” and more restaurants are buying locally grown food. Selling directly to consumers used to be more common; however, in the 1940’s farmers’ markets started to disappear as the number of small farms declined and grocery stores consolidated their purchases to fewer farms that could produce more. Farmers’ markets have made a comeback since then and now many individuals want to know how their food is grown and where it comes from.
Some reasons why farmers’ markets have made an increase in the last decade include animal abuse at large food corporations has pushed some people to go to farmers’ markets to see where their food is from. Also, buyers trust the people who sell their home grown food creating a relationship with the producer. Others go because the food is fresh and due to the taste of locally grown food. Shoppers must perceive a value in going to a farmers’ market to get produce, while for some it may be convenient, it typically takes a special trip. While farmers’ markets have individual importance to people; the USDA included $10 million in grants to promote farmers’ markets in their 2011 year budget as opposed to $0 in 2006 (MacLachlan 2010). Not only do farmers’ markets help people obtain local food it also helps the farmer. For instance when a farmer sells their produce to the grocery store, they only get less than 10 percent of the final retail value. At the farmers’ market, the grower receives 100 percent (MacLachlan 2010).

By going to farmers’ markets, people promote animal welfare and environmentally responsible growing practices. Many people also go for flavorful vegetables and fruit and farmers’ markets are one of the easiest ways to get fresh produce. With continued support for local food and the importance that comes from the knowledge of where someone’s food comes from. The growth of farmers’ markets will continue not only in Wisconsin but around the nation.

**Community Supported Agriculture**

Wisconsin is also a leader in the number of community supported agriculture (CSA) farms. CSA’s operate by acquiring members in the area that want to receive weekly pick-ups of seasonal produce. A farmer offers a certain number of “shares” to the public which people can buy a “membership” to receive a box of fresh produce each week throughout the farming season or biweekly if they want more produce. CSA’s support civic agriculture, which is defined as the
trend towards locally, based agriculture and food production that is tightly linked to a community’s social and economic development (Lyson 2004). In 2001, there were 400 community supported agriculture organizations and it has increased to 1,144 CSA’s in 2005 in Wisconsin (Lyson 2004). Many government programs and policies support local food such as Community Food Project Grants Program, Women, Infants and Children (WIC) Farmers’ Market Nutrition Program, and National Farmers’ Market Promotion Program. State and local policies also promote local food markets and offer incentives for consumers to shop at farmers markets and join community supported agriculture programs.

**Food Desert in Urban Core**

There has been a growing concern of whether people living in cities have access to affordable and healthy food. In urban areas there has been a retail and service decline including food retail. If there are fewer grocery stores in the area, it may be difficult to access fresh food. Many grocery stores left poor neighborhoods in the city to suburban areas where shopping patterns were more even. This left many families without access to healthy food in many areas with increasing poverty. The USDA, in 2008 reported 49.1 million people lived in food insecure households, including 16.7 million children (Reid 2012). There is evidence that supports the concept that residents will make better health choices if they are presented with the option to do so (Reid 2012). By supporting community based agriculture and farmers’ markets, more people will have access to fresh food.
Urbanization

The world’s population has dramatically increased to over 7 billion people. With more people, a greater density is found in cities where there is development. The U.S. Population Census of 2000 define urban areas as block groups that have a population density of at least 1,000 people per square mile with surrounding census blocks that have a density of at least 500 people per square mile. In the Southeastern part of Wisconsin, the main urban areas include: Milwaukee, Kenosha, Racine and Waukesha. Milwaukee is the biggest urban area with a population density of 3,926 per square mile. With a growing population, there is increasing pressure put on obtaining large quantities of food to feed everyone in the city.

Geographic Information Systems (GIS)

Geographic Information Systems can be very useful in mapping spatially referenced data and reveal valuable spatial patterns over large geographical areas. Geographic Information System is a computer-based tool that allows you to create, organize, analyze, store and display information based on its location. By the 1980’s GIS started to gain significance and was incorporated in research institutes. The first desktop GIS product started in 1986 and grew from the research department into the business environment. GISDATA was first established in Europe in 1990 and was launched in 1993 (Gatrell 1998). This access to data has increased existing national research efficiency and was more widely used in the Unites States by the end of the 20th century. GIS makes it possible to integrate different kinds of geographic information, such as digital maps, satellite images and Global Positioning System (GPS) data points along with other geographic features.
Accessibility to Local Produce

In order to determine whether access to local produce has increased in Southeastern Wisconsin from 2008 and 2014, an analysis on drive time from urban populations to the nearest farm, farmers’ markets, and community supported agriculture location was calculated and mapped. This will help provide insight on the growth in access to locally grown food in urban areas of Southeastern Wisconsin and whether there is a significant decrease in travel drive time from 2008-2014.
Hypotheses

Hypothesis 1: The distance that urban populations need to travel to access farmers’ markets has significantly decreased from 2008 to 2014 in Southeastern Wisconsin.

Null Hypothesis 1: There has not been a significant decrease in the distance urban populations need to travel to access farmers’ markets from 2008 to 2014 in Southeastern Wisconsin.

Hypothesis 2: The distance that urban populations need to travel to access community supported agriculture drop off locations has significantly decreased from 2008 to 2014 in Southeastern Wisconsin.

Null Hypothesis 2: There has not been a significant decrease in the distance urban populations need to travel to access community supported agriculture drop off locations from 2008 to 2014 in Southeastern Wisconsin.

Hypothesis 3: The distance that urban populations need to travel to access direct purchasing from small farms has significantly decreased from 2008 to 2014 in Southeastern Wisconsin.

Null Hypothesis 3: There has not been a significant decrease in the distance urban populations need to travel to access direct purchasing from small farms from 2008 to 2014 in Southeastern Wisconsin.
Methodology

Study Area

The study area focuses in Southeastern Wisconsin in ten counties including: Dodge, Jefferson, Kenosha, Milwaukee, Ozaukee, Racine, Rock, Walworth, Washington, and Waukesha County (Figure 2). Urban areas focus on Milwaukee, Racine, Waukesha, Washington, Ozaukee, and Kenosha (Figure 3). This study area includes the urban corridor of Milwaukee which has been increasing in urban land uses. Each county has a percentage of urban and rural land based on location in Wisconsin which contributes to the population and number of agricultural farms in that area. In the 2010 Census for Wisconsin; each county had its population and population density recorded, presented in the following table (Table 1).
Figure 3: Map of Urban Areas in Southeastern Wisconsin. The areas shaded in yellow show the focus sites of urban areas in Southeastern Wisconsin.
Table 1: **2010 Population Census Data**. Showing population and population density for each of the ten study counties in Southeastern Wisconsin.

<table>
<thead>
<tr>
<th>County</th>
<th>2010 Census Population</th>
<th>Population Density (Per Square Mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dodge</td>
<td>88,759</td>
<td>101.4</td>
</tr>
<tr>
<td>Jefferson</td>
<td>83,686</td>
<td>150.4</td>
</tr>
<tr>
<td>Kenosha</td>
<td>166,426</td>
<td>611.9</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>947,735</td>
<td>3,926.0</td>
</tr>
<tr>
<td>Ozaukee</td>
<td>86,395</td>
<td>370.7</td>
</tr>
<tr>
<td>Racine</td>
<td>195,408</td>
<td>587.7</td>
</tr>
<tr>
<td>Rock</td>
<td>160,331</td>
<td>223.3</td>
</tr>
<tr>
<td>Walworth</td>
<td>102,228</td>
<td>184.2</td>
</tr>
<tr>
<td>Washington</td>
<td>131,887</td>
<td>306.2</td>
</tr>
<tr>
<td>Waukesha</td>
<td>389,891</td>
<td>709.4</td>
</tr>
</tbody>
</table>

Along with population, the 2012 Agriculture Census data provided the number of farms in each county plus the percentage of urban and rural lands. The divide between rural and urban locations can be beneficial when locating farmers’ markets, farms, and community supported agriculture locations.

Table 2: **2012 Agriculture Census Data**. Showing the number of farms, percent rural land, and percent urban land in each of the ten counties in Southeastern Wisconsin.

<table>
<thead>
<tr>
<th>County</th>
<th>2012 Agriculture Census</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Farms</td>
</tr>
<tr>
<td>Dodge</td>
<td>2,012</td>
</tr>
<tr>
<td>Jefferson</td>
<td>1,225</td>
</tr>
<tr>
<td>Kenosha</td>
<td>359</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>82</td>
</tr>
<tr>
<td>Ozaukee</td>
<td>416</td>
</tr>
<tr>
<td>Racine</td>
<td>575</td>
</tr>
<tr>
<td>Rock</td>
<td>1,509</td>
</tr>
<tr>
<td>Walworth</td>
<td>870</td>
</tr>
<tr>
<td>Washington</td>
<td>712</td>
</tr>
<tr>
<td>Waukesha</td>
<td>557</td>
</tr>
</tbody>
</table>
**Data Acquisition**

Data regarding the ten counties used in this study in Southeastern Wisconsin was collected from the 2014 Wisconsin Farm Fresh Atlas ([http://www.farmfreshsewi.org/pdf/2014-FFA-SE-WI.pdf](http://www.farmfreshsewi.org/pdf/2014-FFA-SE-WI.pdf)). The 2014 Farm Fresh Atlas is the 10th edition published by UW Extension. This document is mainly created from volunteer work and this atlas helps get the word out about local produce in the area. Application to be in the atlas starts late summer to fall for distribution in March. The Farm Fresh Atlas works to provide a local food movement where buying local is sustainable as well as to help educate and support the community. Each farm, farmers’ market and community supported agriculture location in the atlas has an address along with information regarding the type of produces available at each site. There were multiple icons to help show what type of food would be at each farm and farmers’ market. Yellow symbolized animal products, green shows different food and vegetables available and the blue which is focused on in this study shows farmers’ markets, on-farm sales, and community supported agriculture (Figure 4).
The Farm Fresh Atlas features farms that are family and cooperatively owned which operate in a way that protects and sustains the region’s land and water resources, provides safe and fair working conditions as well as produce or sell Wisconsin farm products. This local food guide encourages others to educate themselves on where their food comes from and pick food that helps sustain the community and the environment. Buying local helps support the local economy, provide affordable nutritious food to others, obtain a variety of food and help keep the atmosphere a little cleaner by not buying food across the country.

There are over eighty thousand copies of the Farm Fresh Atlas distributed to the public each year to bring people to local farms and farmers’ markets to help improve access to local food. There are 110 farms listed in the 2014 Farm Fresh Atlas including information such as:
address, contact information, produce and availability icon as well as a description of what the farm sells. Under farmers’ markets, there are 83 markets listed under all ten counties with information including: a local address and contact information such as name, phone number as well as days and times the market will be open to the public. Community Supported Agriculture, Roadside Stands, U-Pick and On-Farm Sales are represented with icons under farms and markets where these different types of access to local produce are available (Figure 4). Two years of data were obtained, 2008 and 2014 Farm Fresh Atlas’s were used to compare the number of farms and to see the growth in access to local food in urban areas.

The 2010 Population Census was used to obtain data regarding population levels in southeastern counties of Wisconsin (http://www.census.gov/2010census/). Population census data came from 2010 for both 2008 and 2014 of the Wisconsin Farm Fresh Atlas. The Census Bureau determined urban and rural block groups based on population density data (Table 1). Different population levels in each of the ten counties focused in this study in southeast Wisconsin impact the percentage of rural and urban land per county (Table 1 & 2). These demographics helped show differences between counties in southeastern Wisconsin and show the relationship between access to local food and other social factors.

The 2012 Agriculture Census helped determine the amount of rural land in southeastern Wisconsin (http://www.agcensus.usda.gov/Publications/2012/). This census also provided information on the number and types of farms per county. By using City Data (http://www.city-data.com/) the percentages of rural and urban lands were broken down for each county. This data was represented with different types of graphs and charts to see different demographics over time. Overall, these websites helped obtain factors influencing the level of rural and urban land in ten different counties in southeastern, Wisconsin.
**Data Analysis**

ArcGIS ArcMap10.1 was used to plot the locations of all farmers’ markets, farms and CSA’s listed in the Farm Fresh Atlas in Southeastern Wisconsin. Each location was geocoded meaning that geographic coordinates were found by affirming an address that would appear on the map. Geocoding combines map information with street addresses in order to locate a point uniquely. Spatial data known as a reference layer is used for the computer to map data and turn an address into a point location. A street layer with specific attributes of address ranges on each street segment match addresses to points on the map.

The projection, North American Datum (NAD) 1983 State Plane Wisconsin South was used to accurately plot farm and market locations, streets, and other layers. Through GIS, it is possible to determine what is within traveling range of a location to help identify distances between populations and facilities including: farms, farmers’ markets, and CSA’s. The traveling range is measured using drive time distance. Block level population counts from the 2010 census were used through a point layer representing the centroids of blocks. For the chosen urban areas in southeastern Milwaukee, there were a total number of 20,384 block-points.

In order to define urban areas in southeastern Wisconsin, the layer of urban boundaries within the United States was used from ESRI Data and Maps 10.1. These urban boundaries include: Milwaukee, Racine, Waukesha, Washington, Ozaukee, and Kenosha. The selected urban areas were then used to clip the ten county study area of southeastern Wisconsin. The clip tool is used to cut out a piece of one feature class using one or more of the features in another feature class as a cookie cutter. To show a streets network in the urban areas studied, the streets layer was clipped. To account for farms, markets, and CSA locations just outside urban areas of Southeastern Wisconsin, a one mile buffer was applied to both the facilities and streets layers.
The “minutes” field was recalculated to accurately portray travel time needed to traverse each street segment. To recalculate minutes, length in meters was defined using the calculate geography tool. Then to get minutes in time, the length in meters was divided by the speed which was converted from miles per hour to meters per minute.

To define the distance between population block-points and small farms, farmer’s markets and CSA’s; a network data set was built from the streets layer to calculate travel time distance to obtain fresh produce. A network data set creates a topological line layer based on streets to help account for driving time such as turns and speed limit. Then by selecting the facility which in this case is the different farms, farmer’s markets or CSA locations multiple drive time intervals can be calculated. By using, “Select by Location” through time intervals polygons, block-points were selected for odd intervals in minutes from 1 to 15. Then intervals went up by 5 to 45 minutes. This provided a travel time in minutes to the closest farm, market, and CSA for each block point. Using Field Calculator, times were assigned for selected block points excluding previous calculated results at lower time intervals using “Select by Attribute”. These tools in ArcGIS will help determine the availability and growth in access to locally grown produce in urban areas.
Statistical Analysis

Statistical analysis used for this study included finding an average drive time from block points to the closest facility by year for farmers’ markets, farms and CSA’s. To help determine whether to reject the null hypothesis of no difference in the mean drive times, a t-test of paired observations was run to compare 2008 and 2014 data. The t-test is an inferential statistic that is used to examine the statistical significance between drive time from population block-points to farmers’ markets, farms and CSA locations between the years 2008 and 2014 to determine if there was a significant increase in the access of local produce over time. This would be determined by the p-value given in the calculation of the t-test with the level of statistical significance at .05. Overall, descriptive and inferential statistics helped determine whether the results are significant in that population in urban areas have greater access to locally grown food.
Results

While there is a lot of readily available information about farmers’ markets, farms, and CSA’s, there is not a large source of research done on driving times between the public and local vendors. Given the rise in popularity of eating organic and eating a balanced diet, when healthier options are convenient, more people are likely to participate. With the presence of buying locally, it helps the community economically and provides members with fresh and flavorful produce.

The impact of farmers’ markets, farms and CSA’s relies on the people who put the time and effort to grow food and set up markets for members in a community. Within cities, there is less open land to utilize to grow produce. Farms and CSA’s on the outskirts of urban areas help keep local food an accessible option for people. More markets are proving to be a growing transition from grocery stores to buying produce locally grown.

While there is growing interest in buying localized organic food, it is important to see how accessible farmers’ markets, farms and CSA’s are to populations within urban areas of southeastern Wisconsin. In order to determine access in terms of minutes travelled to buy fresh food, quantitative data was utilized. The following maps provide quantitative data which will determine the time it would take to travel from block points to the closest farmers’ markets, farms, and CSA’s within urban areas of southeastern Wisconsin.

A map was created to show the distribution of 2008 and 2014 farms within urban areas of southeastern Wisconsin (Figure 5). It is evident that there are fewer farms in the center of Milwaukee which is the most densely populated out of all the studied counties and more within the surrounding areas such as in Racine and in Waukesha. The map also shows the increase in farms within the Farm Fresh Atlas from 7 in 2008 to 10 in 2014. There is a clear increase in the
county of Racine and Waukesha. A streets layer was added to help as a reference layer along with urban areas shown in yellow.
Figure 5: Farm Fresh Atlas Urban Farms. This map shows the locations of farms within urban areas in relation to streets in Southeastern Wisconsin counties.
The following map (Figure 6) shows 2008 and 2014 farmers’ markets in southeastern urban areas of Wisconsin from the Farm Fresh Atlas. This map displays a cluster of farmers’ markets in Milwaukee in 2014. There is an increase in the number of farmers’ markets from 29 in 2008 to 48 in 2014.
Figure 6: Farm Fresh Atlas Urban Farmers’ Markets. This map shows the locations of farmers’ markets within urban areas in relation to streets in Southeastern Wisconsin counties.
The Farm Fresh Atlas map below (Figure 7) shows CSA locations within the study site. There are not many CSA’s in urban areas; however, the growth from 2008 to 2014 goes from one CSA to four in 2014. In both years, CSA’s in the Farm Fresh Atlas are found in only Waukesha and Milwaukee.
Figure 7: Farm Fresh Atlas Urban CSA’s. This map shows the locations of CSA’s within urban areas in relation to streets in Southeastern Wisconsin counties.
The subsequent maps (Figures 8-13) show drive time increasing from one minute, up to the furthest between thirty-five and forty minutes away from farms, farmers’ markets or CSA’s. Drive time is symbolized with different graduated colors for each type of location. Farms are shown in green with close locations in a light green and increasing in darkness the further away from the farm. Farmers’ markets drive time is depicted in blue and CSA drive time is shown in purple.

In 2008, there were 7 farms in urban areas of southeastern Wisconsin (Figure 8). There were more farms located in Waukesha with few in other counties. In relation to drive time, it is apparent that a greater percentage of the population of urban areas would have to drive between nine and thirty-five minutes to reach a local farm. The mean drive time to reach a farm in 2008 is 12.81 minutes with the most frequent drive time being 21 minutes (p-value < 0.001) (Table 3).
Figure 8: Farm Drive Time 2008. This map shows the drive times from population block points to the closest farms in the Farm Fresh Atlas in 2008 within urban areas in Southeastern Wisconsin counties.
Farms in 2014, increased from 2008 to 10 farms in urban locations of southeastern Wisconsin (Figure 9). More farms are located in Racine, and some farm locations differ between 2008 and 2014. For drive time, in Racine the drive time is within 9 minutes for urban populations; however, for the majority of urban population the drive time is at an average of 15.82 minutes which is more than the average drive time in 2008 (p-value < 0.001) (Table 3). The most frequent drive time for population is 20 minutes to reach the closest farm in 2014.
Figure 9: Farm Drive Time 2014. This map shows the drive times from population block points to the closest farms in the Farm Fresh Atlas in 2014 within urban areas in Southeastern Wisconsin counties.
In the Farm Fresh Atlas for 2008, there were 29 farmers’ markets within urban areas (Figure 10). There is a cluster of farmers’ markets found in Milwaukee and another cluster in Kenosha. For most of the population, it would take an average of 6.51 minutes to reach the nearest farmers’ market (p-value = 2.41E-247) (Table 3). The most frequent drive time out of all the block-points is 5 minutes.
Figure 10: Farmers’ Markets Drive Time 2008. This map shows the drive times from population block points to the closest farmers’ markets in the Farm Fresh Atlas in 2008 within urban areas in Southeastern Wisconsin counties.
Within the study area, there are 48 farmers’ markets located in 2014. Like the previous map there are still clusters of farmers’ markets in Milwaukee and Kenosha. However, in the map below there is also a cluster in Racine and more farmers’ markets throughout Milwaukee and Waukesha (Figure 11). The average drive time in 2014, would take 5.34 minutes to arrive at the closest farmers’ market (p-value = 2.41E-247) (Table 3). The most frequent drive time for population block-points remains close to the average of 5 minutes (Table 3). The overall average in drive time from 2008 to 2014 decreased from 6.51 to 5.34 minutes to reach a farmers’ market in urban regions (p-value = 2.41E-247) (Table 3).
Figure 11: Farmers’ Market Drive Time 2014. This map shows the drive times from population block points to the closest farmers’ markets in the Farm Fresh Atlas in 2014 within urban areas in Southeastern Wisconsin counties.
In 2008, there were only 2 CSA locations in the Farm Fresh Atlas (Figure 12). One CSA is located in Milwaukee and the other is in Waukesha. The average drive time to reach either of these locations was 17.99 minutes (p-value = 1.66E-116) (Table 3). The most frequent drive time out of all the block-points was near 20 minutes to reach the nearest CSA location.
Figure 12: CSA Drive Time 2008. This map shows the drive times from population block points to the closest CSA’s in the Farm Fresh Atlas in 2008 within urban areas in Southeastern Wisconsin counties.
The Farm Fresh Atlas listed 4 CSA locations in 2014 (Figure 13). One of these listed CSA is the same listed in 2008 in Milwaukee. The average time to drive to the closest CSA in 2014 was 15.24 minutes (p-value = 1.66E-116) (Table 3). The most frequent value in minutes for CSA’s was twenty minutes away. This average value dropped from 17.99 to 15.24 minutes from 2008 to 2014 (p-value = 1.66E-116) (Table 3).
Figure 13: CSA Drive Time 2014. This map shows the drive times from population block points to the closest CSA’s in the Farm Fresh Atlas in 2014 within urban areas in Southeastern Wisconsin counties.
The table below shows the average drive time in minutes to reach the closest farm, farmers’ market, and CSA location for year 2008 and 2014 (Table 3). The table below shows the t-test results comparing both years in 2008 and 2014 for farms, farmers’ markets, and CSA’s to obtain a p-value showing significance at the .05 level (Table 3).

Table 3: Average Drive Time to Locations and t-test Results. Displays the average drive time and p-value with a significance level of .05 for farms, farmers’ markets, and CSA locations comparing drive time from 2008 with 2014.

<table>
<thead>
<tr>
<th>Type</th>
<th>2008 Drive Time (Minutes)</th>
<th>2014 Drive Time (Minutes)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farms</td>
<td>12.81</td>
<td>15.82</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Farmers’ Markets</td>
<td>6.51</td>
<td>5.34</td>
<td>2.41E-247</td>
</tr>
<tr>
<td>CSA’s</td>
<td>17.99</td>
<td>15.24</td>
<td>1.66E-116</td>
</tr>
</tbody>
</table>
Discussion

The above maps help display the growth in access to local produce, specifically in farmers’ markets. In Milwaukee, the most growth is seen with an increase in farmers’ markets from 2008 to 2014. This growth is relevant and correlates with past research including *Counting Farmers Markets* by Allison Brown. The trend of increased numbers of farmers’ markets has increased along with popularity to eat healthy and fresh food. The increase in farmers’ markets give residents a means to obtain fresh produce in urban areas as well as travel fewer miles in order to save energy and time required to buy fresh food. The average drive time from 2008 to 2014 decreased from 6.51 minutes to 5.34 minutes. The p-value of 2.41E-247 suggests that Null Hypothesis #1 can be rejected with an extremely high level of statistical significance. This in turn supports hypothesis #1, in that the distance urban populations need to travel to access farmer’s markets has decreased from 2008 to 2014 in Southeastern Wisconsin.

Community supported agriculture farm locations in past research have increased in number of CSA locations between 2001 and 2005 in Wisconsin (Lyson 2004). The number of CSA’s in urban areas in Wisconsin only increased by three from 2008 to 2014. This increase could have resulted from changes in demand and CSA programs that change with farms over the years. The drive time did decrease from 17.99 to 15.24 minutes between the two years. The p-value was 1.66E-116, meaning that the chance is extremely slim to be wrong by rejecting Null Hypothesis #2. This supports hypothesis #2, the distance urban populations need to travel to access community supported agriculture drop off locations has decreased from 2008 to 2014.

For farms listed in the Farm Fresh Atlas, while the number of farms increased between the years, the drive time actually increased from an average drive time of 12.81 to 15.82 minutes between 2008 and 2014. Farms have provided a means for people to buy local food and know
how the food has been grown. Unfortunately, urban areas have less access to open land to grow food compared to rural areas incurring a longer drive time compared to farmers’ market locations. The p-value < 0.001, suggests that the null hypothesis of equal means between 2008 and 2014 can be rejected with significant statistical confidence, and there is an increase in the distance urban populations need to travel to access direct purchasing from small farms from 2008 to 2014. All in all, where the mean in 2008 is less than the mean in 2014 for drive time, I can reject the null hypotheses with more than 99% confidence.

These maps help show the distribution in drive time between population block-points and different locations where fresh produce would be available. It is clear that there is greater access to farmers’ markets in urban areas compared to farms and CSA’s. Farms are found on the edges of urban areas and most CSA’s originate on farms. The average drive time to farms was more in 2014 than in 2008 even with the overall quantity increasing between these years. As for CSA locations, most are found within certain farms meaning they are typically further away. According to the data, CSA’s are roughly fifteen to twenty minutes away making it less convenient compared to farmers’ markets which are only about five minutes away. Overall, in urban areas, farmers’ markets are the best means of obtaining fresh food grown locally.
**Future Work**

Farmers’ markets and CSA locations revealed a decrease in the average drive time between 2008 and 2014. These values were statistically significant, represented by a t-test. Even though a 1 mile buffer was added to account for farms, markets, and CSA locations, near the urban area boarder, a larger buffer possibly would have helped reject null hypothesis #3. Null hypothesis #3 stated that there has not been a significant decrease in the distance urban populations need to travel to access direct purchasing from small farms from 2008 to 2014 in southeastern Wisconsin. For the CSA drive time maps, including a buffer that extended to Racine and Kenosha would help define which location would be closest to population block-points in those counties.

For future work, creating a buffer increasing in mileage until the counties of Racine and Kenosha were represented with drive time would be recommended. This would help show the drive time from population block-points in Racine and Kenosha to CSA locations within the urban area. By increasing the buffer would also include other facilities outside the urban area that would be closer to block-points on the edge of the urban area. These block-points closest facility are most likely outside urban areas. While this study focused on access mainly within urban areas, to get a better understanding of accessibility to local food both within and outside urban areas the buffer should be extended to include more farm and CSA locations outside the urban area.

While this study looked at travel time between different locations and urban population in southeastern Wisconsin, further work could be done in regards to obtaining more data on current facilities under urban farms and CSA’s. For instance, the Farm Fresh Atlas only includes a list of
farms and farmers’ markets willing to pay a small fee to have their information in the atlas. Some places may not be listed or not be listed consistently from year to year.
Conclusion

After completing this research, hypotheses #1 and #2 were confirmed showing that the distance in overall drive time decreased with statistical significance for urban populations to access farmers’ markets and CSA’s from 2008 to 2014 in Southeastern Wisconsin. Null Hypothesis #3 was rejected where the mean in 2008 is less than the mean in 2014 for drive time to farms, I can reject the null hypotheses with more than 99% confidence.

Driving long distances to obtain food causes a stress on the environment and produce loses freshness along the way. Buying locally in urban areas, helps stimulate the community and provide fresher food compared to food that would typically travel long miles to reach peoples plates. Urban agriculture is more sustainable using environmentally friendly practices to grow fresh produce. Farmers’ markets were found to be closer to the majority of urban populations compared to farms and CSA’s. Overall, human influence in local organic produce has driven the progress and number of farmers’ markets in urban areas in southeastern Wisconsin.
Works Cited


